Using Description Logic to Manage Question Corpora

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Abstract
If clinical questions are to be used on a large scale as a practitioner interface to the medical knowledge base, improved methods must be developed for the semantic management of question corpora. In this project we investigate the use of description logic to manage question corpora. We propose the addition of a Q-box to a standard Description Logic knowledge base. The Q-box will contain concept descriptions that are not yet accepted as part of the T-box, but in effect represent questions about concepts already described in the T-box.

Introduction
The study of question corpora as a practitioner interface to the medical knowledge base is a topic of increasing interest in healthcare.[1] It is important to investigate whether the use on a large scale of questions as a practitioner interface will actually improve access to the medical knowledge base, and lead to improvements in patient health and safety outcomes. In order to investigate the benefits of this use of questions, improved methods must be developed for the semantic management of question corpora. The syntax, semantics, and logic of questions have long been studied.[2;3] In this project we investigate the use of description logic (DL)[4] to semantically manage question corpora. In particular we address two satisfiability problems: whether the questions used as an interface are logically at odds with each other (and so are not co-satisfiable), or whether those questions are at odds with our background knowledge.

Methods
A DL knowledge base consists of a *T-box* and an *A-box*.[4] The T-box contains descriptions of concepts and the A-box contains assertions about individuals. We propose the addition of a *Q-box*. The Q-box contains concept descriptions that are not yet accepted as part of the T-box, but in effect represent questions about concepts already described in the T-box. For example, the T-box (representing background knowledge of concepts) may contain the following property-value restriction statement for the concept *strep-negative pharyngitis*: "For all x, if x is *strep-negative pharyngitis*, there exists a y such that x *has as an effective symptomatic treatment* y and y is *saline gargle*". To put it more colloquially, the description of *strep-negative pharyngitis* includes the condition that an effective symptomatic treatment for it is saline gargle. On the other hand, the Q-box may contain the property-value restriction statement, "For all x, if x is *strep-negative pharyngitis* then there exists a y such that x *has as an effective therapy* y and y is *antibiotic therapy*". By including that property-value restriction in the Q-box, we are in effect asking whether antibiotic therapy is effective for *strep-negative pharyngitis*.

Comment
Usual methods allow us to determine whether the Q-box itself, or the union of Q-box and T-box, is logically satisfiable. An ontology editor similar to OilEd[5] can be used to alert us to the fact that questions we are asking are logically at odds with each other, or are at odds with our background knowledge, by indicating when the associated concepts are unsatisfiable. Such an alert system can help us better manage question corpora and track ontological inconsistencies that may confound their use as practitioner interfaces to the medical knowledge base. However, while we think this approach promising, it is clear that many types of questions can not be represented as the DL property-value restriction statements considered here. Further work is required to investigate the extent of types of questions that may be represented as DL statements.

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References
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